Hydrological Restoration of Rincon Bayou, Nueces Marsh

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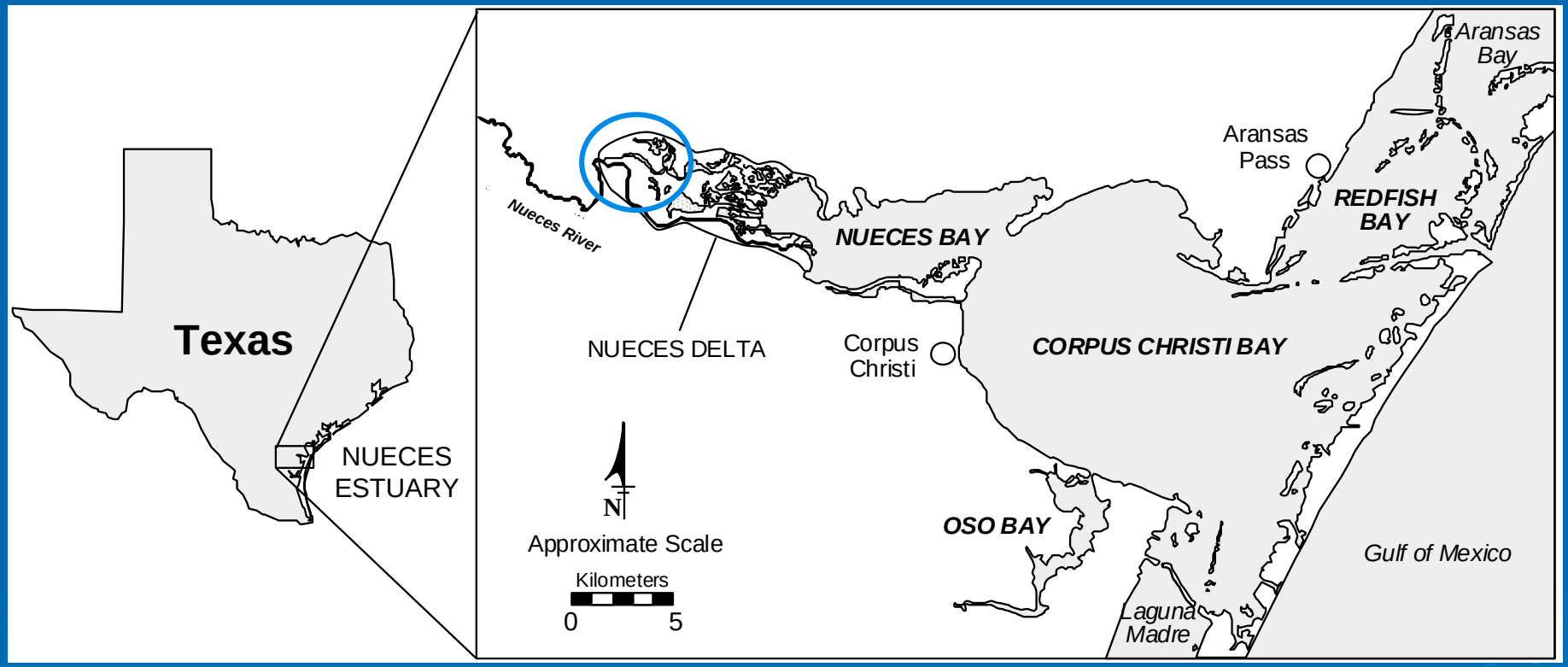
TEXAS A&M UNIVERSITY CORPUS CHRISTI | HARTE RESEARCH INSTITUTE FOR GULF OF MEXICO STUDIES

Prelude

Nueces River entering Nueces Bay

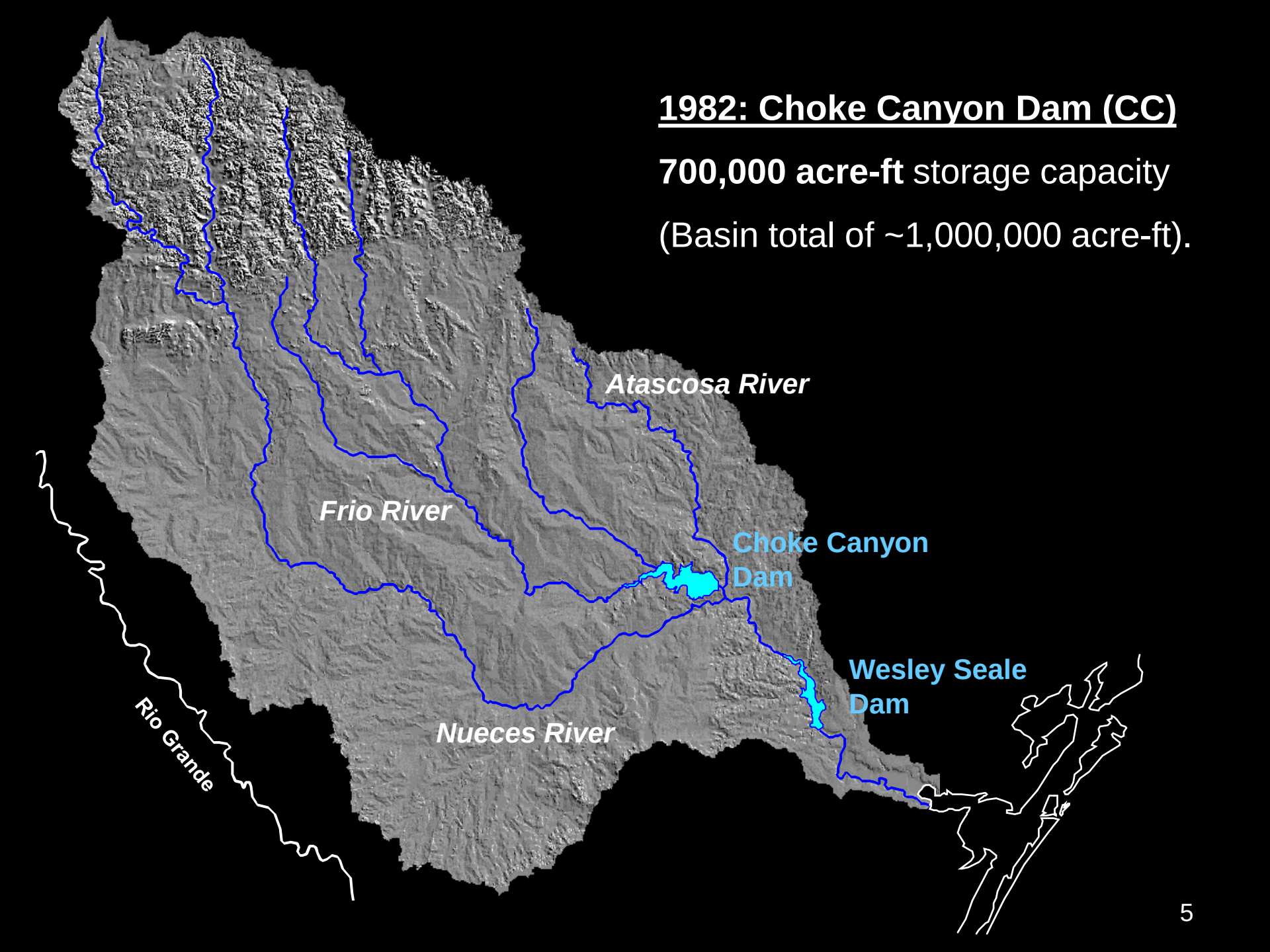
- Data presented here originates from many projects funded by BOR, CCC, CBBEP TWDB, and HRI
- This presentation is based on Final Reports to CBBEP and TWDB:
  - Montagna, P.A., C. Chaloupka, E. DelRosario, A. Gordon, and E.L. Turner. 2016. Effects on Benthic Macrofauna from Pumped Flows to Rincon Bayou. Final Report to the Coastal Bend Bays & Estuaries Program for Project # 1617. Harte Research Institute, Texas A&M University-Corpus Christi, Corpus Christi, Texas, 61 pp.
  - Montagna, P.A., L. Adams, C. Chaloupka, E. DelRosario, R.D. Kalke, and E.L. Turner. 2016. Determining Optimal Pumped Flows to Nueces Delta. Final Report to the Texas Water Development Board, Contract # 1548311787. Harte Research Institute, Texas A&M University-Corpus Christi, Corpus Christi, Texas, 75 p.

Nueces Estuary



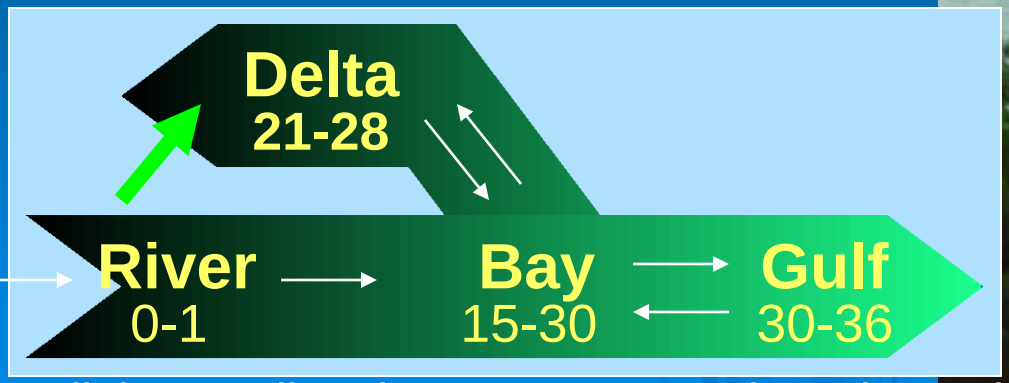
- Near Corpus Christi, Texas
- Semi-arid climate, water shortages in dry years
- Reverse estuary


Nueces Basin is about 4.3 million ha
Atascosa River
Frio River
Nueces River
Rio Grande
Nueces Bay
Corpus Christi Bay

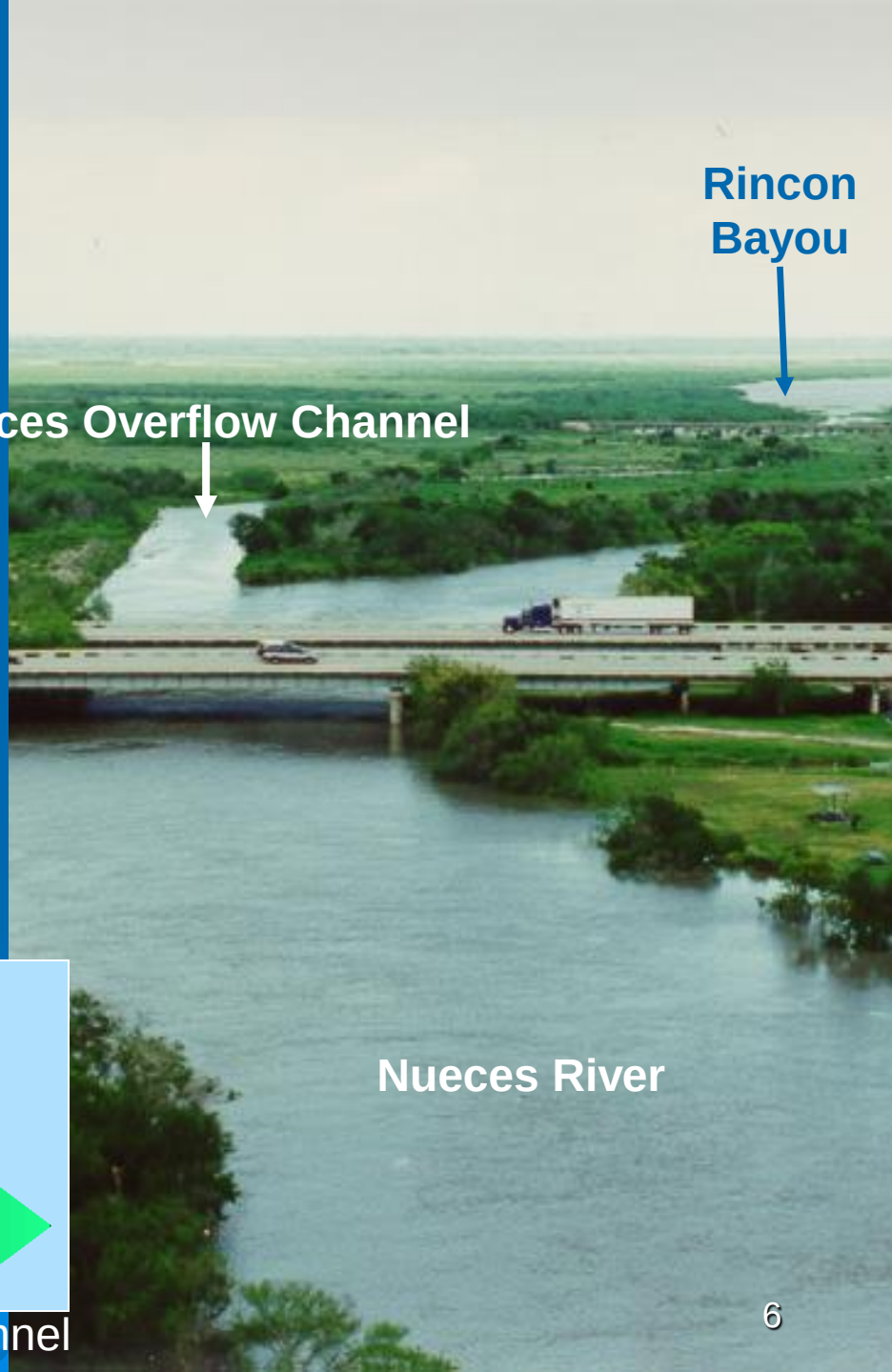

1982: Choke Canyon Dam (CC)
700,000 acre-ft storage capacity
(Basin total of ~1,000,000 acre-ft).
Atascosa River
Frio River
Choke Canyon Dam
Wesley Seale Dam
Nueces River
Rio Grande

Hydrologic Restoration

- 1996-2000 – Nueces Overflow Channel
  - Small bit of water decreased salinity and increased estuary structure and function
- 2000 – Channel closed
- 2001 – Channel opened



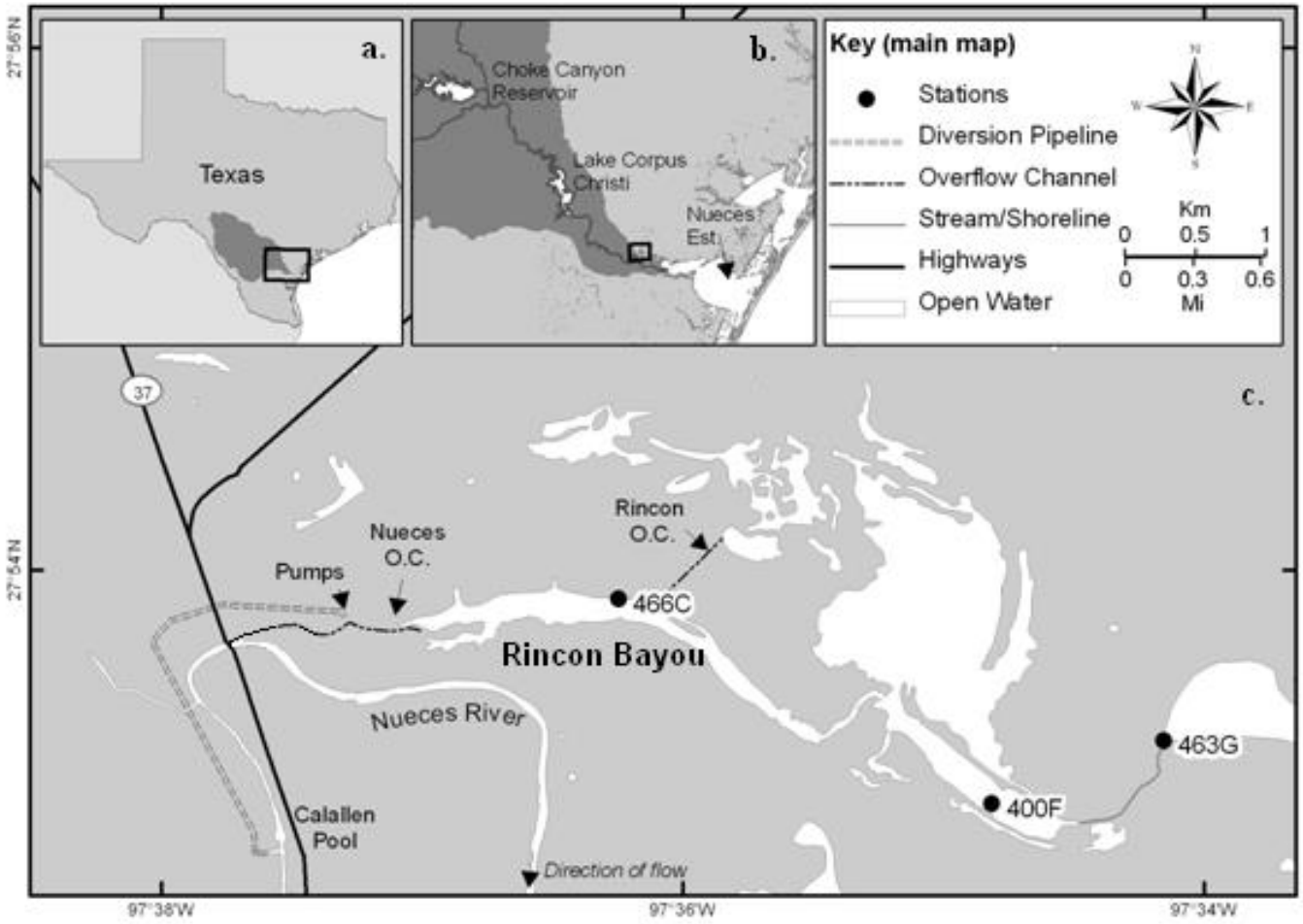
Salinity Gradient in Components After Channel



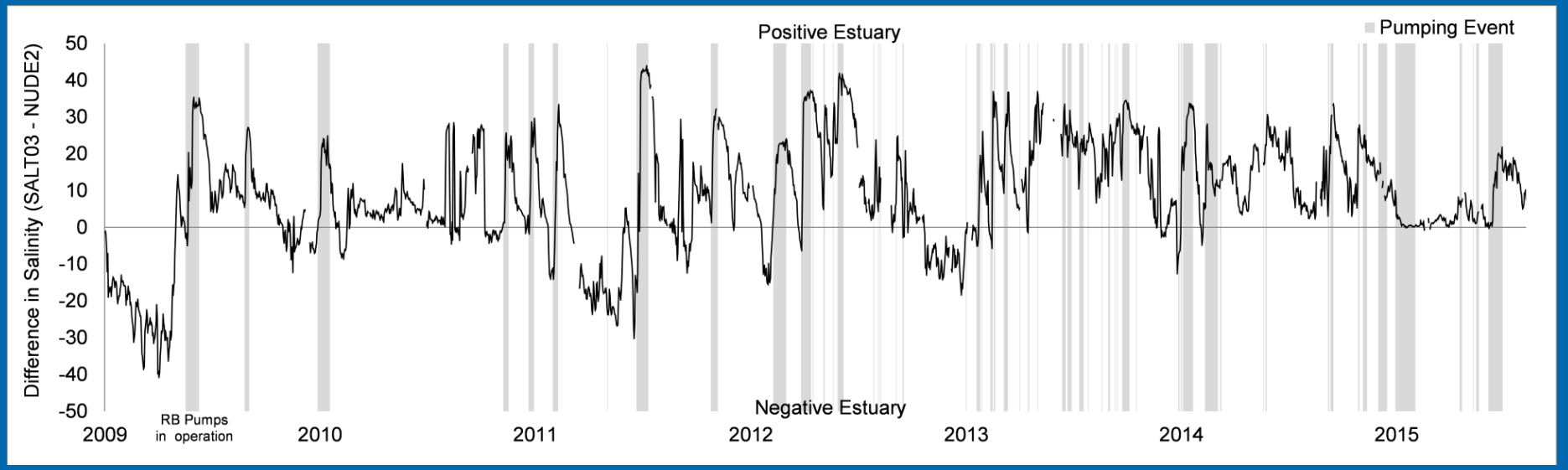
Rincon Bayou Pipeline

- 2009 - City of Corpus Christi completed construction to pass-through the first 3,000 acre-ft (3,700,440 m^3) per month from the Calallen Pool to Rincon Bayou

Rincon Pipeline Location

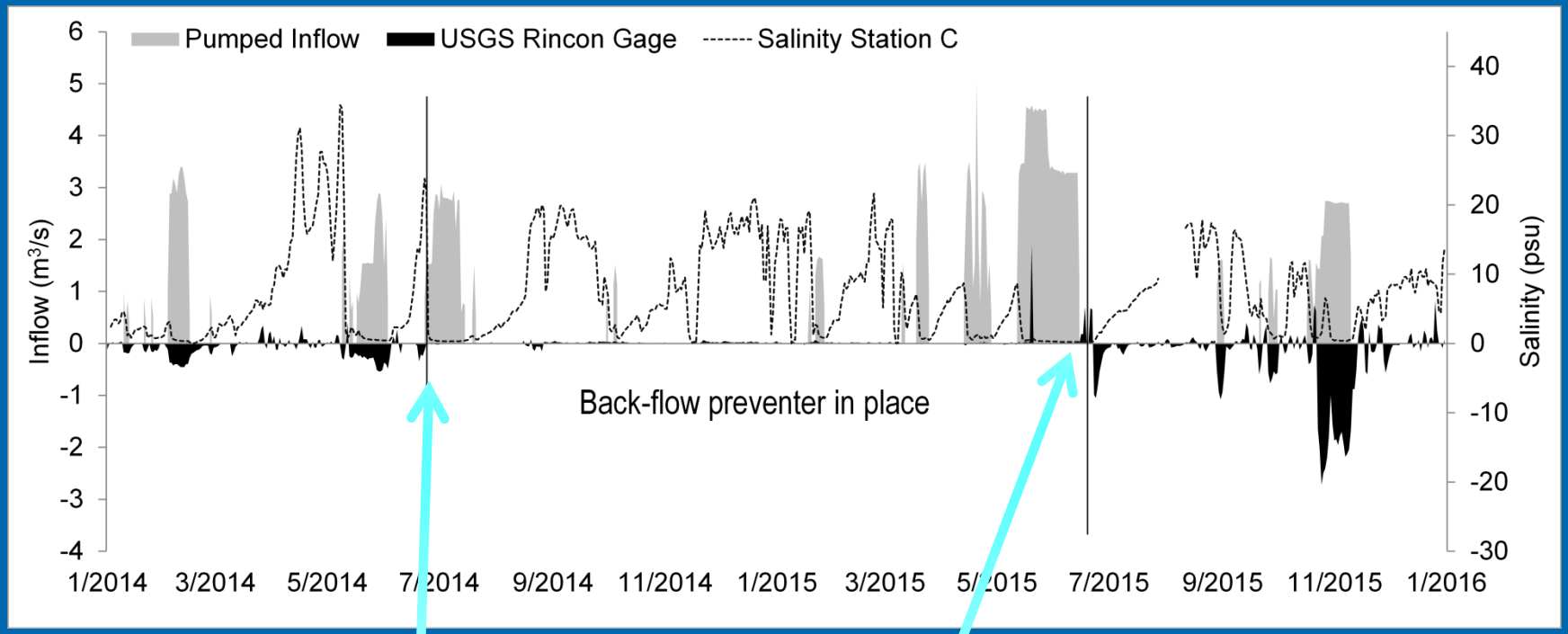


Conversion to a Positive Estuary



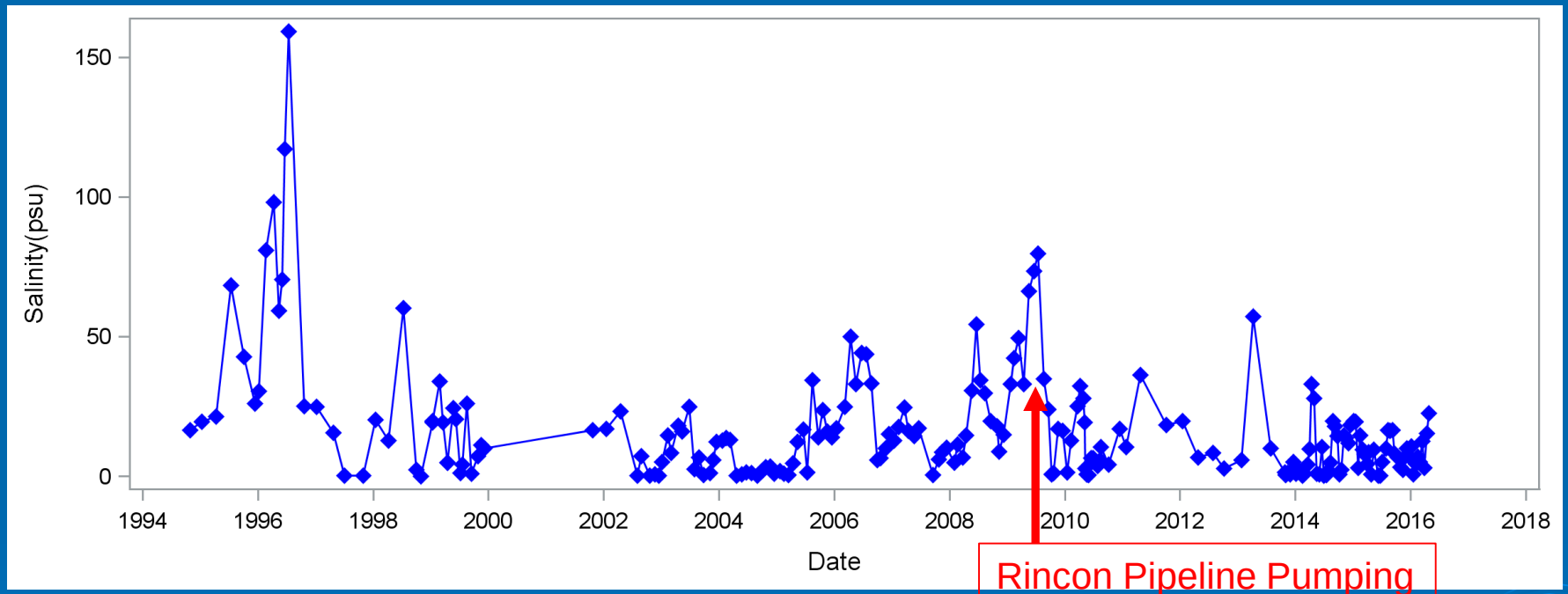
- The salinity gradient = upstream (NUDE2) - downstream (SALT03)
- Negative estuary condition
  - Salinity at SALT03 < Salinity at NUDE2
- Positive estuary condition
  - Salinity at SALT03 > Salinity at NUDE2

Pumping, Flow, Salinity



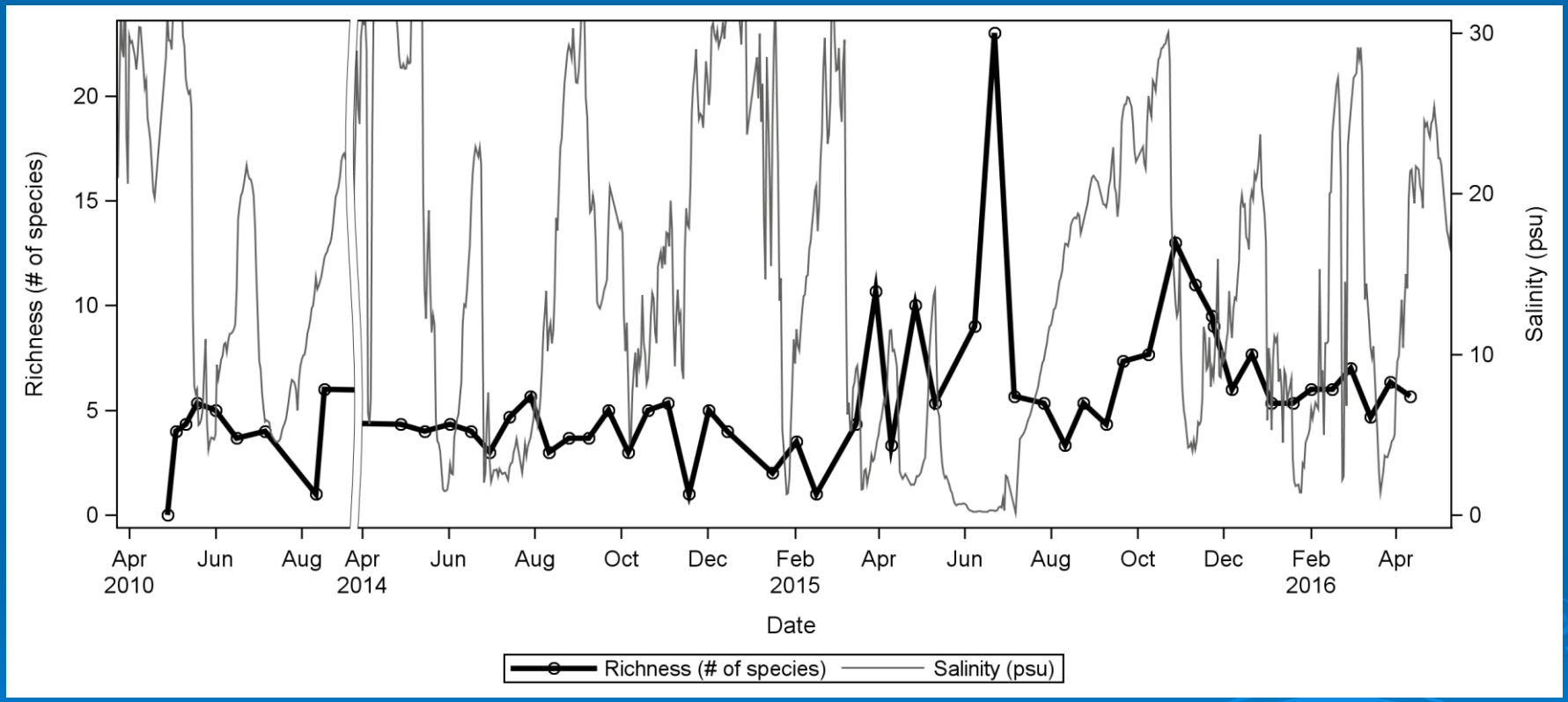
- Initially flow went upstream
- Backflow preventer added July 2014
- Washed out July 2015

Long-Term Salinity Change



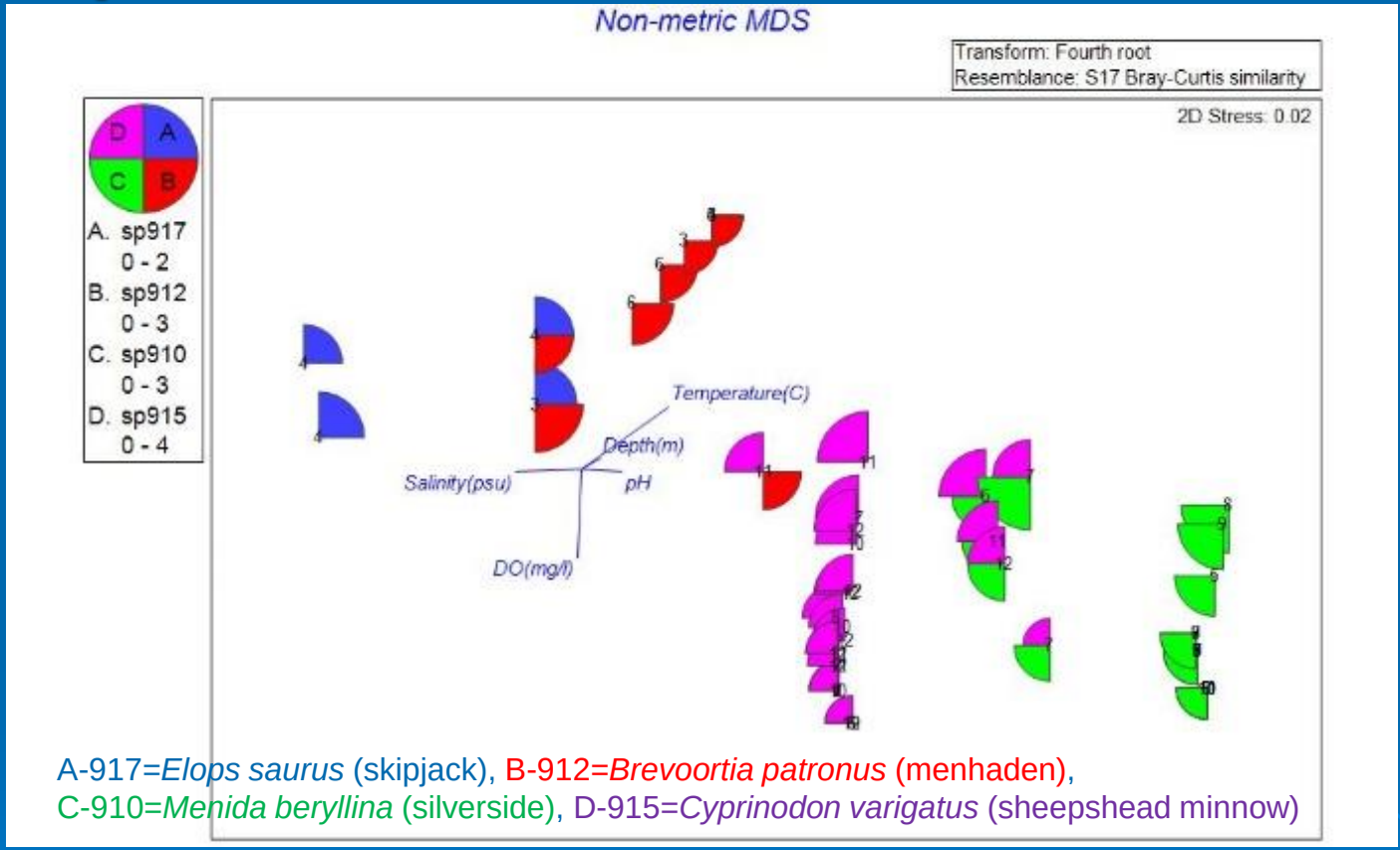
- Previous hypersaline conditions reduced since 2009 when pump began operation

Benthic Epifauna Diversity



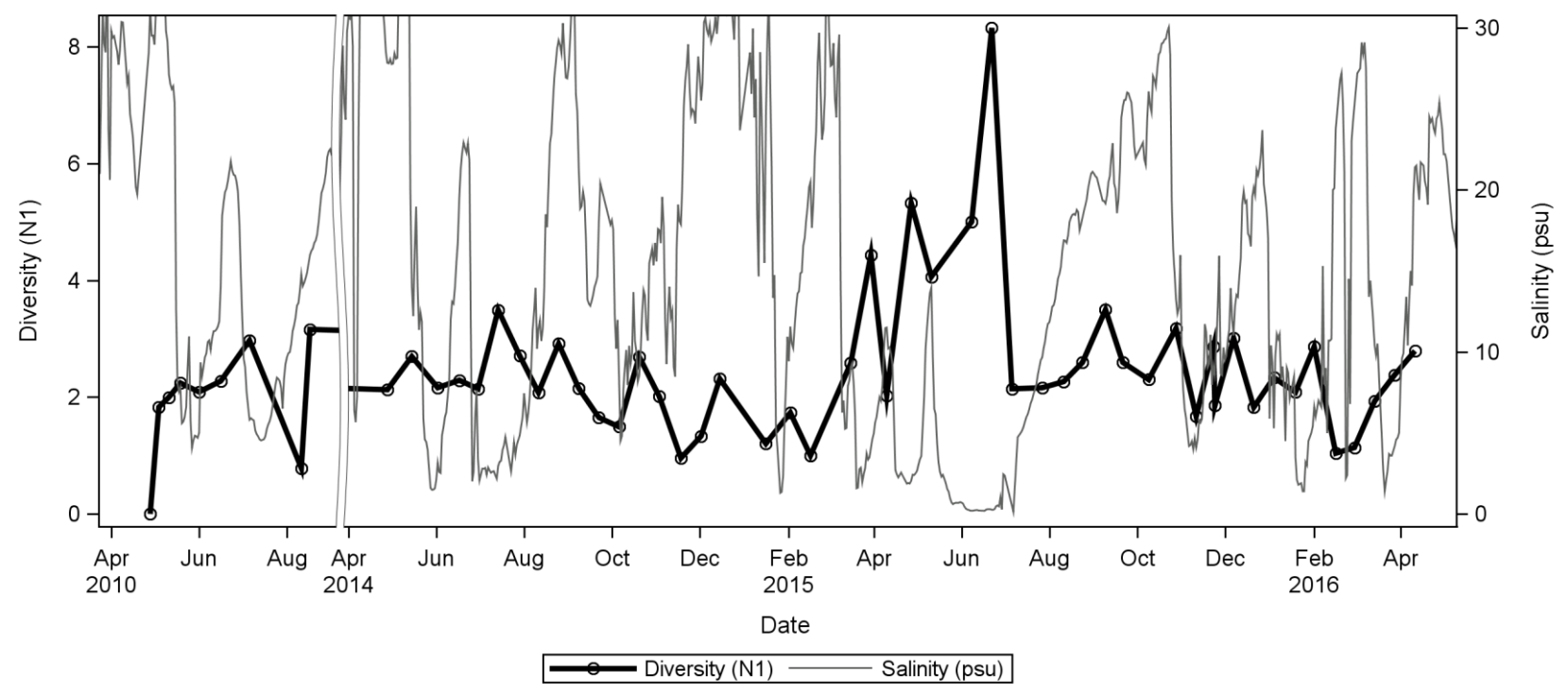
- Diversity is low because of frequent salinity swings, which cause disturbances

Epifauna Communities



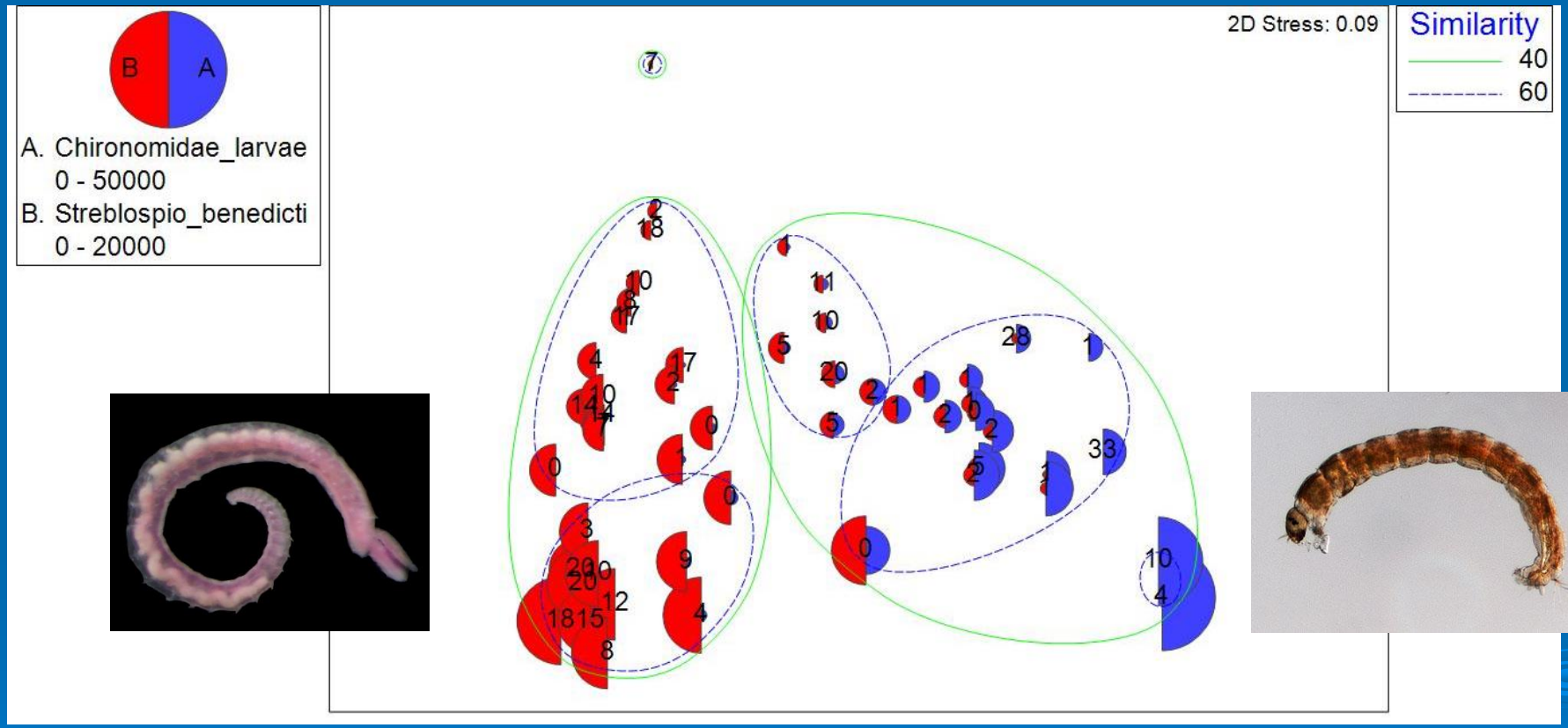
- Push nets used to sample fish and invertebrates
- Salinity gradient from left to right
  - Skipjack at lowest salinity and sheepshead at highest

Benthic Infauna Diversity



- Sediment cores for infauna
- Only 12 infauna species total, compared to 100's in the bay
- Average about 4 per sample date

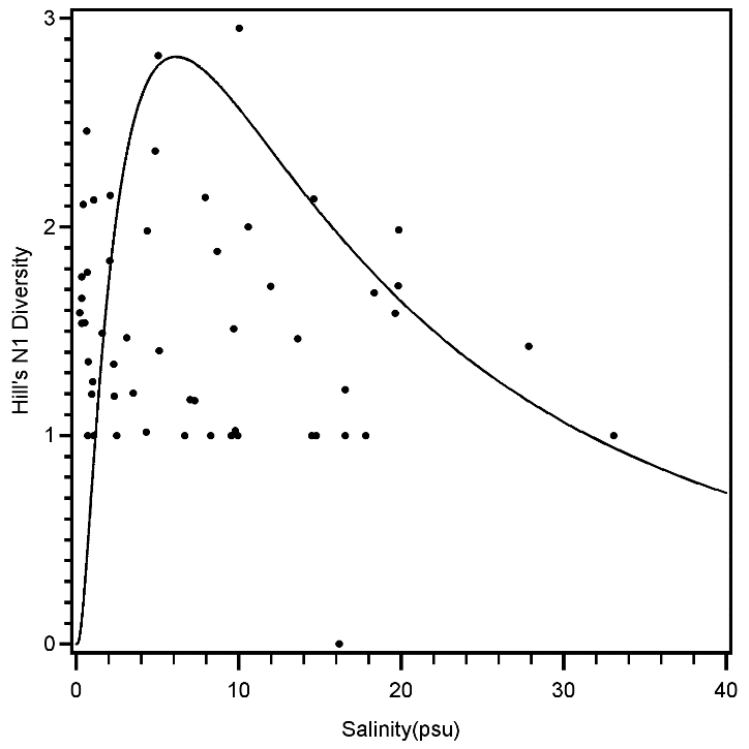
Infauna Community Structure

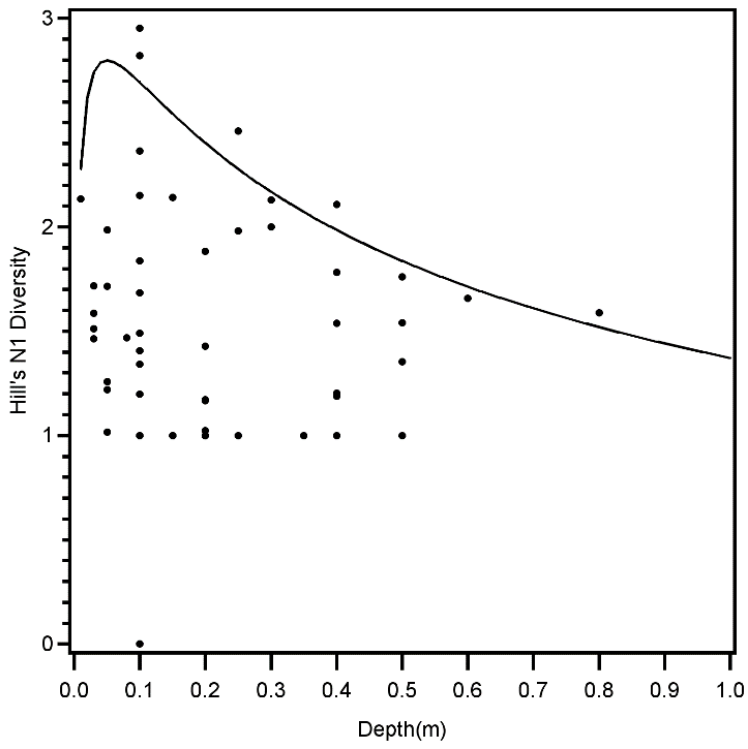


- Chironomid larvae dominate when salinity is low, and *Streblospio benedicti* dominate when salinity is high

Benthic Infauna Diversity

Turner and Montagna (2016) Max Bin Method

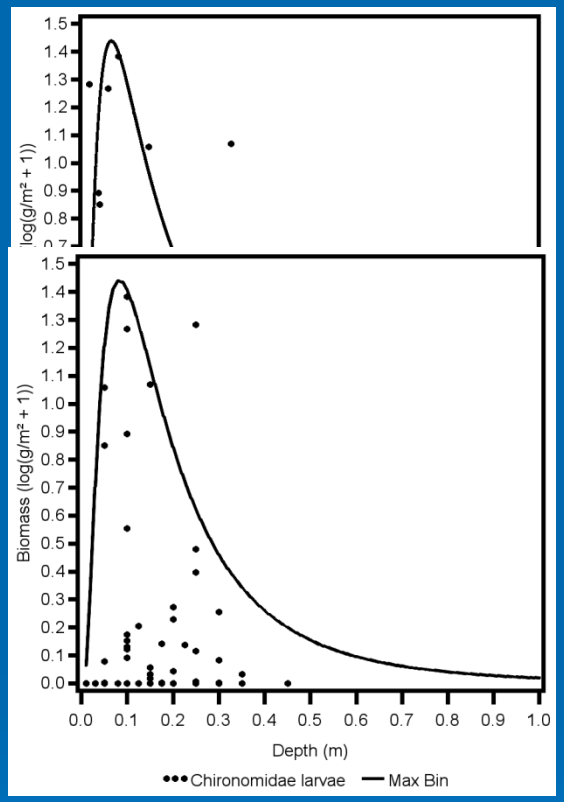


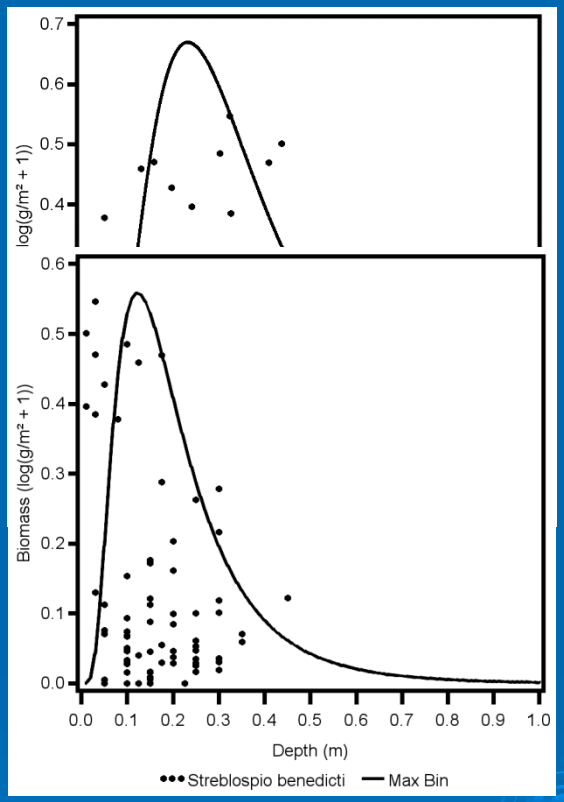


- Diversity peaks with salinity between 4 psu and 10 psu
- Diversity peaks with water depth around 10 cm

Calculate Optimal Salinities

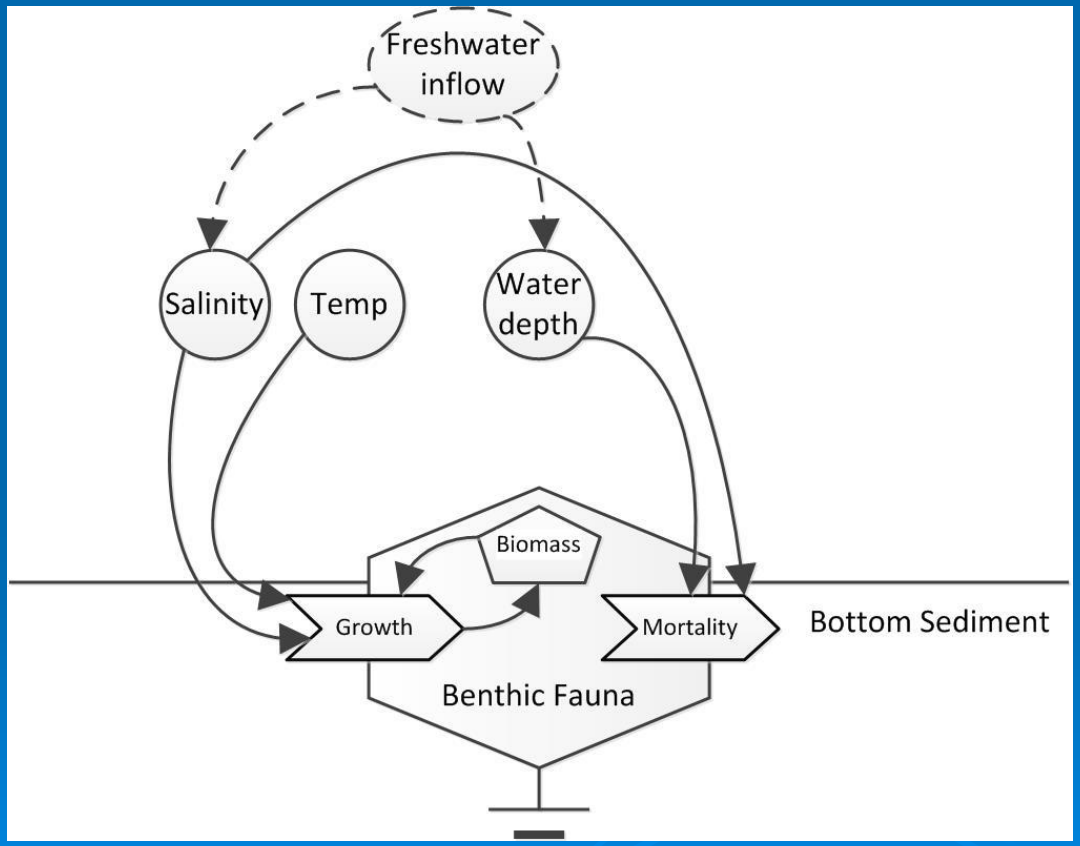
Turner and Montagna (2016) Max Bin Method IN PRESS





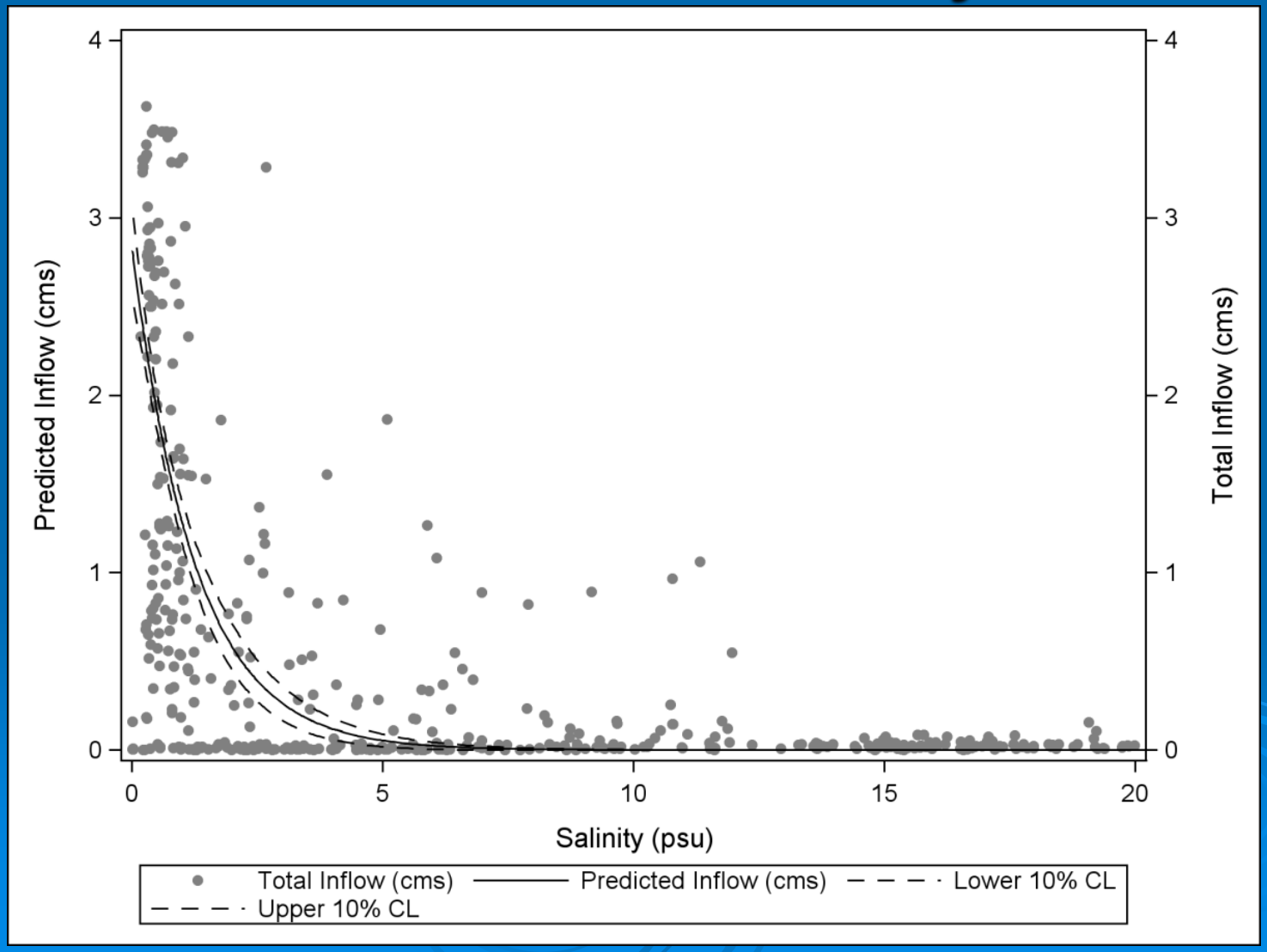
Metric	Chironomidae larvae	Streblospio bendicti
Abundance	1.3 psu, 9 cm	13.5 psu, 12 cm
Biomass	1.8 psu, 8 cm	14.1 psu, 12 cm

Modelling Benthic Communities

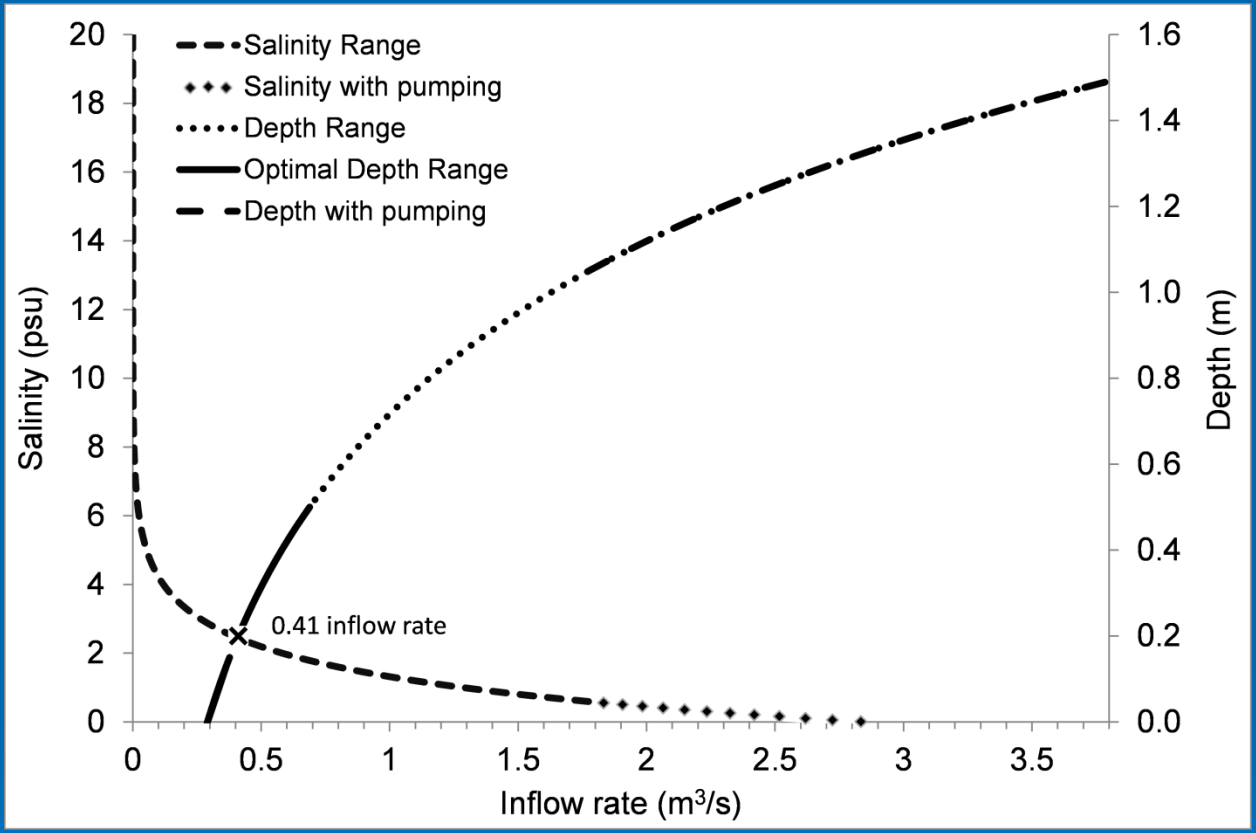


- Predicting species responses from physical changes in Rincon Bayou
- 65 % to 81 % accuracy

Calculate Flow Needed to Maintain Salinity



Optimal Pumping



- Pumping controls salinity and water depth
- Based on indicators, 0.41 m^3/s (29 ac-ft/day) would maintain optimal salinity and depth for bioindicators

Conclusions

- Rincon Bayou is a disturbed environment exhibiting low diversity and constant community state shifts with wet and dry periods
- While hydrological restoration has helped Rincon Bayou, more changes are necessary
  - Inflows should be a trickle, not a flood
  - Releases should be continuous and not haphazard
  - Specifically:
    - Only one pump should be used at a time, which will take about 24 days (at 126 ac-ft/d) to deliver 3,000 ac-ft/month
    - Releases should not be timed for end of month because that requires 3 pumps over a short time period making floods worse
    - Releases should not be dependent on pass-through requirements because you need them most during dry periods

Acknowledgements

- Coastal Bend Bays & Estuaries Program
- Texas Water Development Board
- Harte Research Institute
- Too many colleagues, students, postdocs, and technicians to mention since 1994

Questions?